Amendments to the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (currently amended) A method for using a computer processor to interpolatively code input waveform signals, in which said signals decomposed into or are composed of a slowly evolving waveform ~~and other attributes or components~~, ~~the method incorporating at least one of the following steps~~ comprising inputting waveform signals to the computer and a step selected from the group consisting of:

(a) using the computer processor to perform analysis-by-synthesis quantization of the dispersion phase such that the linear shift phase attribute is reduced or eliminated from the quantization;

(b) using the computer processor to process a group of adjacent pitch values and weighting them to compute a weighted average in order to compute the most probable value of pitch

(c) using the computer processor to incorporate spectral and temporal pitch searches, such that the temporal search is performed at a different rate than the spectral search;

(d) using the computer processor to incorporate temporal weighting in the an analysis-by-synthesis vector-quantization of the gain sequence;

(e) using the computer processor to quantize adjacent values by analysis-by-synthesis vector-quantization without downsampling or interpolation of the gain values;

(f) using the computer processor to incorporate switch prediction or switched filtering in an analysis-by-synthesis vector-quantization of the gain sequence;

(g) using a coder in which a plurality of bits therein are allocated to the vector-quantization of the dispersion phase of the slowly evolving waveform phase from which the linear shift attribute was reduced or removed; ~~or~~ and

(h) using the computer processor for pitch searching using varying boundaries of the summations used in computing the similarity or an equivalent distortion measure used for the pitch search.

Claim 2 (original) The method of claim 1 in which said signal is speech.

Claim 3 (currently amended) The method of claim 1 in which said method incorporates each of steps (a) through (~~l~~ h).

Claim 4 (previously presented) The method of claim 1 in which in the step of analysis-by-synthesis vector-quantization of the slowly evolving waveform, distortion is reduced in the signal by obtaining the accumulated weighted distortion between a sequence of input waveforms and a sequence of quantized and interpolated waveforms.

Claim 5 (currently amended) The method of claim 1 ~~including a system~~ for providing at least one codebook containing magnitude and dispersion phase information for predetermined waveforms, and in which the step of analysis-by-synthesis quantization of the dispersion phase is conducted by crudely aligning the linear phase of one or the other of the input and output, then iteratively shifting said crudely aligned linear phase input or output, comparing the shifted input or output to a plurality of waveforms reconstructed from the magnitude and dispersion phase information contained in said at least one codebook, and selecting the reconstructed waveform that best matches one of the iteratively shifted inputs or outputs.

Claim 6 (currently amended) The method of claim 1 in which in the method of temporal domain searching the instantaneous pitch period in said step comprises defining boundaries of segments of said summations used to compute similarity ~~or an equivalent distortion measure for pitch search~~, selecting the best boundary such that maximizing the similarity, or minimizing the distortion, measure by

iteratively shifting and by changing the length of the segments used for the summations used in the measure computations.

Claim 7 (currently amended) The method of claim 1 in which the spectral domain pitch and temporal domain pitch searches [,] are conducted ~~at different rates~~.

Claim 8 (original) The method of claim 1 in which the step of the temporal weighting in the analysis-by-synthesis vector-quantization of the signal gain is changed as a function of time whereby to emphasize local high energy events in the input signal.

Claim 9 (currently amended) The method of claim 1 in which selection between the high and low correlation synthesis filters in the analysis-by-synthesis vector-quantization of the signal gain is made to maximize similarity ~~or other meaningful objective~~ between the input target gain vector and a reconstructed vector.

Claim 10 (pr eviously presented) The method of claim 1 wherein each value of gain in the analysis-by-synthesis vector-quantization of the signal gain is used to obtain a plurality of shapes, each composed of a predetermined codebook having a number of entries, and comparing said shapes to an input target vector and selecting the reconstructed shape that maximizes the similarity to the input target vector.

Claim 11 (canceled)

Claim 12 (currently amended) The method for using a computer processor to quantize waveforms <u>comprising inputting waveform signals to the computer and</u> ~~by the step of~~ using the accumulated distortion between adjacent input waveforms and adjacent quantized and interpolated output waveforms to quantize said waveforms.

Claim 13 (currently amended) A method for using a computer processor to interpolatively code input waveform signals in which the signal decomposed into or composed of attributes or components one of which is a slowly evolving waveform, which has or from which one can extract dispersion phase, comprising inputting waveform signals to the computer and ~~the method using the step of~~ incorporating analysis-by-synthesis quantization of the dispersion phase.

Claim 14 (previously presented) The method of claim 13 including providing at least one codebook containing magnitude and dispersion phase information for predetermined waveforms, crudely aligning the linear phase of the input, then iteratively shifting said crudely aligned linear phase input, and/or comparing the shifted input, or equivalently shifting the quantized vector, to a plurality of vectors reconstructed from the magnitude and dispersion phase information contained in said at least one codebook, and selecting the reconstructed vector that best matches the input vector or one of the iteratively shifted input vectors.

Claim 15 (currently amended) A method for using a computer processor to interpolatively code input waveform signals in which the signal decomposed into or composed of attributes or components one of which is a slowly evolving waveform, which has or from which one can extract dispersion phase, comprising inputting waveform signals to the computer and ~~the method using the step of~~ incorporating analysis-by-synthesis quantization of the dispersion phase, including providing at least one codebook containing magnitude and dispersion phase information for predetermined waveforms, crudely aligning the linear phase of the input, then iteratively shifting said crudely aligned linear phase input, and/or comparing the shifted input, or equivalently shifting the quantized vector, to a plurality of vectors reconstructed from the magnitude and dispersion phase information contained in said at least one codebook, and selecting the reconstructed vector that best matches the input vector or one of the iteratively shifted input vectors, in which the average global distortion measure for a particular vector set M is:

$$\frac{1}{M}\sum_{m=\{Data\ Vector\}}\frac{1}{K_m}\sum_{k=1}^{K_m} w_{kk,m}\left|r(k)_m - e^{j\hat{\varphi}(k)_m}\left|\hat{r}(k)\right|_m\right|^2$$

and including the step of minimizing the global distortion thereof by using the following formula for the k-th harmonic's phase for the j-th cluster:

$$\hat{\varphi}(k)_{j^{th}-cluster} = \operatorname{atan}\left[\frac{\sum_{m=\{j^{th}-cluster\}}\frac{1}{K_m} w_{kk,m}\left|r(k)_m\right|\sin(\varphi(k)_m)}{\sum_{m=\{j^{th}-cluster\}}\frac{1}{K_m} w_{kk,m}\left|r(k)_m\right|\cos(\varphi(k)_m)}\right].$$

16 (currently amended) A method for using a computer processor to interpolatively code input waveform signals in which the signal decomposed into or composed of attributes or components one of which is a slowly evolving waveform, which has or from which one can extract dispersion phase, <u>comprising inputting waveform signals to the computer and</u> ~~the method using the step of~~ incorporating analysis-by-synthesis quantization of the dispersion phase, including providing at least one codebook containing magnitude and dispersion phase information for predetermined waveforms, crudely aligning the linear phase of the input, then iteratively shifting said crudely aligned linear phase input, and/or comparing the shifted input, or equivalently shifting the quantized vector, to a plurality of vectors reconstructed from the magnitude and dispersion phase information contained in said at least one codebook, and selecting the reconstructed vector that best matches the input vector or one of the iteratively shifted input vectors, in which the average global distortion measure for a particular vector set M is:

$$\frac{1}{M}\sum_{m=\{Data\ Vectors\}}\frac{1}{K_m}\sum_{k=1}^{K_m} w_{kk,m}\left|r(k)_m - e^{j\hat{\varphi}(k)_m}|\hat{r}(k)|_m\right|^2$$

and including the step of minimizing the global distortion thereof by using the following formula for the k-th harmonic's phase for the j-th cluster:

$$\hat{\varphi}(k)_{j^{th}-cluster} = \mathrm{atan}\left[\frac{\sum_{m=\{j^{th}-cluster\}}\frac{1}{K_m}w_{kk,m}|\hat{r}(k)_m||r(k)_m|\sin(\varphi(k)_m)}{\sum_{m=\{j^{th}-cluster\}}\frac{1}{K_m}w_{kk,m}|\hat{r}(k)_m||r(k)_m|\cos(\varphi(k)_m)}\right]$$

Claim 17 (currently amended) A method for using a computer processor to interpolatively code input waveform signals ~~input signals~~, comprising inputting waveform signals to the computer and ~~comprising the steps of~~ using spectral and temporal pitch searches, computing a number of adjacent pitch values, and then computing the most probable pitch value by computing the weighted average pitch value using the above said weight.

Claim 18 (previously presented) The method of claim 17 in which in the method of searching the temporal domain pitch comprises defining a boundary for a segment used for the summations in the computed measure used for the pitch search, selecting the boundaries of the segment that maximize the similarity, or minimize the distortion measure, used for the pitch search, by iteratively shifting and expanding the segment and by shifting the segment.

Claim 19 (currently amended) A method for using a computer processor to interpolatively code input waveform signals ~~input signals~~, comprising inputting

waveform signals to the computer and ~~comprising the steps of~~ using spectral and temporal pitch searches, computing a number of adjacent pitch values, and then computing the most probable pitch value by computing the weighted average pitch value using the above said weight, in which in the method of searching the temporal domain pitch comprises defining a boundary for a segment used for the summations in the computed measure used for the pitch search, selecting the boundaries of the segment that maximize the similarity, or minimize the distortion measure, used for the pitch search, by iteratively shifting and expanding the segment and by shifting the segment, and is in accordance with the formula:

$$P(n_i) = \underset{\tau, N_1, N_2}{\arg\max} \left\{ \rho(n_i, \tau, N_1, N_2) \right\} =$$

$$\underset{\tau, N_1, N_2}{\arg\max} \left\{ \frac{\sum_{n=n_i-N_1\Delta}^{n_i+\tau+N_2\Delta} s_w(n) s_w(n-\tau)}{\sqrt{\sum_{n=n_i-N_1\Delta}^{n_i+\tau+N_2\Delta} s_w(n) s_w(n)} \sqrt{\sum_{n=n_i-N_1\Delta}^{n_i+\tau+N_2\Delta} s_w(n-\tau) s_w(n-\tau)}} \right\}$$

where t is the shift in the segment, D is some incremental segment used in the summations for computational simplicity, and Nj is a number calculated for the codes.

Claim 20 (currently amended) A method comprising inputting waveform signals to ~~for using~~ a computer processor ~~to use~~ and using a weighted average to compute one pitch value out of a set of pitch values of ~~a~~ the waveform signal, in accordance with the formula:

$$P_{mean} = \sum_{i=1}^{5} \rho(n_i) P(n_i) / \sum_{i=1}^{5} \rho(n_i)$$

$$P_{mean} = \sum_{i=1}^{M} \rho(n_i) P(n_i) / \sum_{i=1}^{M} \rho(n_i)$$

where M is the number of averaged pitch values and $\Delta(n_i)$ is the normalized correlation for $P(n_i)$.

Claim 21 (original) The method of claim 19 in which the spectral domain pitch and temporal domain pitch searches in said step of locking onto the most probable pitch period of the signals are conducted respectively at 100 Hz and 500 Hz.

Claim 22 (currently amended) A method for using a computer processor to perform vector quantization of a waveform signal gain sequence, comprising inputting waveform signals to the computer and using ~~the step of~~ analysis-by-synthesis.

Claim 23 (previously presented) The method of claim 22 including using temporal weighting, and in which the temporal weighting is changed as a function of time whereby to emphasize local high energy events in the input signal.

Claim 24 (previously presented) The method of claim 22, comprising applying synthesis filter or predictor, which introduces selected high correlation or low correlation to a vector quantizer codebook in the analysis-by-synthesis vector-quantization of the signal gain sequence whereby to add selected self correlation to the codebook vectors.

Claim 25 (previously presented) The method of claim 24 in which selection between the high and low correlation synthesis filters or predictor is made to maximize similarity between the signal vector and a reconstructed vector.

Claim 26 (previously presented) The method of claim 22, comprising using each value of gain index in the analysis-by-synthesis vector-quantization of the signal gain.

Claim 27 (previously presented) The method of claim 22 wherein each value of gain index is used to select from a plurality of shapes and associated predictors or filters, each of which is used to generate an output shape vector, and comparing the output shape vector to an input shape vector.

Claim 28 (previously presented) The method of claim 27 in which said plurality of shapes has a predetermined number of values in the range of 2 to 50.

Claim 29 (previously presented) The method of claim 27 in which said plurality of shapes has a predetermined number of values in the range of 5 to 20.

Claim 30 (currently amended) A method for using a computer processor to interpolatively code input waveform signals in which said signals decomposed into or are composed of a slowly evolving waveform and other attributes or components, comprising inputting waveform signals to the computer and using a coder in which a plurality of bits therein are allocated to the vector-quantization of the dispersion phase of the slowly evolving waveform phase from which the linear shift attribute was reduced or removed.

Claim 31 (previously presented) The method of claim 30 in which at least one bit is allocated to the dispersion phase.

Claim 32(currently amended) A method comprising inputting waveform signals to a computer and ~~for~~ using a the computer processor to simplify accumulated distortion between a set of adjacent input vectors of a waveform signal, r_{m2} to a set of quantized and interpolated vectors

$\hat{\mathbf{r}}$

$$D_{wI}(\hat{\mathbf{r}}_M, \{\mathbf{r}_m\}_{m=1}^{M+L-1}) = \begin{bmatrix} \sum_{m=1}^{M} [\mathbf{r}_m - \tilde{\mathbf{r}}_m]^H \mathbf{W}_m [\mathbf{r}_m - \tilde{\mathbf{r}}_m] \\ + \sum_{m=M+1}^{M+L-1} [1-\alpha(t_m)]^2 [\mathbf{r}_m - \tilde{\mathbf{r}}_M]^H \mathbf{W}_m [\mathbf{r}_m - \tilde{\mathbf{r}}_M] \end{bmatrix}$$

by an equivalent simple distortion between only one input and one optimized output vector:

$$D_w(\hat{\mathbf{r}}_M, \mathbf{r}_{M,opt}) = (\hat{\mathbf{r}}_M - \mathbf{r}_{M,opt})^H \mathbf{W}_{M,opt} (\hat{\mathbf{r}}_M - \mathbf{r}_{M,opt})$$

where the step of computing optimal vector $r_{M,opt}$ is given by:

$$\mathbf{r}_{M,opt} = \mathbf{W}_{M,opt}^{-1} \begin{bmatrix} \sum_{m=1}^{M} \alpha(t_m) \mathbf{W}_m [\mathbf{r}_m - [1-\alpha(t_m)] \tilde{\mathbf{r}}_0] \\ + \sum_{m=M+1}^{M+L-1} [1-\alpha(t_m)]^2 \mathbf{W}_m \mathbf{r}_m \end{bmatrix}$$

and the respective weighting matrix $W_{M,opt}$ is given by:

$$\mathbf{W}_{M,opt} = \sum_{m=1}^{M} \alpha(t_m)^2 \mathbf{W}_m + \sum_{m=M+1}^{M+L-1} [1-\alpha(t_m)]^2 \mathbf{W}_m$$

Claim 33 (currently amended) ~~A~~ The method ~~and a system for quantizing waveform using the simplification method~~ of claim 32 such that the respective quantized vector $\hat{\mathbf{r}}_M$ is given by:

$$\hat{\mathbf{r}}_M = \underset{\mathbf{r}'_i}{\operatorname{argmin}} \left\{ (\mathbf{r}'_i - \mathbf{r}_{M,opt})^H \mathbf{W}_{M,opt} (\mathbf{r}'_i - \mathbf{r}_{M,opt}) \right\}$$

Claim 34 (previously presented) The method of claim 17 in which the step of computing a number of adjacent pitch values includes some weight associated with their probability , and including using the normalized autocorrelations obtained for each pitch value, or some function of the autocorrelation, as its associated probability weight used to compute the weighted average pitch value.

Claim 35 (previously presented) The method of claim 12 including using accumulated spectrally weighted distortion.

Claim 36 (currently amended) The method ~~and a system~~ of claim 22 including using a switch predictive synthesis filter or predictor.